Mr. Layne Carter, NASA Marshall Space Flight Center
Layne Carter was hired by NASA in 1988 after receiving a B.S. degree in Chemical Engineering from Oklahoma State University. He also received a M.S. degree in Environmental Engineering from the University of Alabama in Huntsville. During his 28 years at NASA, Mr. Carter has worked on the development, design, delivery and operation of the ISS Water Recovery System (WRS), which includes the Water Processor Assembly (WPA) and Urine Processor Assembly (UPA). His current role is the ISS Water Subsystem Manager, for which he is responsible for the ongoing operation of the water management and WRS on ISS. In addition, he is the co-Lead for NASA's Advanced Exploration Systems (AES) Wastewater Processing and Water Management team, which has the responsibility for developing the technologies to be used for NASA's future manned missions.

Development of Reliable Life Support Systems

The life support systems on the International Space Station (ISS) are the culmination of an extensive effort encompassing development, design, and test to provide the highest possible confidence in their operation on ISS. Many years of development testing are initially performed to identify the optimum technology and the optimum operational approach. The success of this development program depends on the accuracy of the system interfaces. The critical interfaces include the specific operational environment, the composition of the waste stream to be processed and the quality of the product. Once the development program is complete, a detailed system schematic is built based on the specific design requirements, followed by component procurement, assembly, and acceptance testing. A successful acceptance test again depends on accurately simulating the anticipated environment on ISS. The ISS Water Recovery System (WRS) provides an excellent example of where this process worked, as well as lessons learned that can be applied to the success of future missions. More importantly, ISS has provided a test bed to identify these design issues. Mechanical design issues have included an unreliable harmonic drive train in the Urine Processor's fluids pump, and seals in the Water Processor's Catalytic Reactor with insufficient life at the operational temperature. Systems issues have included elevated calcium in crew urine (due to microgravity effect) that resulted in precipitation at the desired water recovery rate, and the presence of an organosilicon compound (dimethylsilanediol) in the condensate that is not well removed by the water treatment process. Modifications to the WRS to address these issues are either complete (and now being evaluated on ISS) or are currently in work to insure the WRS has the required reliability before embarking on a mission to Mars.